IMMUNOLOGY

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IMMUNOLOGY

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KEY TO THIS DOCUMENT

Text in normal font – Must read point. Asked in any previous medical entrance examinations

Text in bold font – Point from Harrison's text book of internal medicine 18th edition

Text in italic font – Can be read if you are thorough with above two.

TRANSPLANTATION

TYPES OF GRAFT

Graft from genetically identical member of same species	Isograft
Isograft indicates transfer of tissue between	Monozygotic twins
Graft from different species	Syngenic graft

GRAFT REJECTION

In prevention of graft rejection, Cyclosporine	Selectively inhibits T cell activation
Neointimal hyperplasia causes vascular graft failure as a result of hypertrophy of	Smooth muscle cells
Initial target for antibodies in graft rejection	Skin Vasculature
Organ associated with Hyperacute rejection	Kidney
Hyperacute graft rejection	*Type II hypersensitivity, irreversible*
Hyperacute rejection due to	Preformed antibodies
Acute graft rejection	*Type IV hypersensitivity, most common type of graft rejection, reversible*
Acute graft rejection occurs within	*12 – 15 days*
Acute humoral renal transplant rejection	Presence of antidonor antibodies, Necrotising vasculitis, Acute cortical necrosis
Chronic graft rejection	*Irreversible, intimal thickening and fibrosis*
Emergency enzyme marker for post transplant monitoring as an aid to diagnosis of acute allograft rejection	Glutathione transferase
Panel reactive antibody PRA < 10% means	**Low risk**
Biopsy for rejection	**Detects c4d deposition by fluorescent labeling**
Humoral rejection is picked by	*4d stain*
Treatment of acute graft rejection	**Glucocorticoid (acts against IL- 6 and IL-1)**
OKT – 3	**Monoclonal antibody (Anti- CD3)**

RUNT DISEASE

Runt disease is due to	Graft versus host reaction
Runt disease	Deficient T cell function
Graft versus host disease	Occurs when host is immunocompromised, common cause is stem cell transplantation, Runt disease, Associated with solid organ transplantation, Graft must contain immunocompetent T cell
Systems affected in graft versus host reaction	*Skin, liver, GIT, bone marrow*
Chronic graft versus host disease simulates	*Systemic sclerosis*

Stage I of GVHD	*Rash < 25% of body area*
Stage II	*Rash 25 – 50% of body area*
Stage III	*Generalized erythroderma*
Stage IV	*Desquamation, bulla, ileus*
Acute graft versus host reaction does NOT occur in	Adrenal
NOT affected in graft versus host reaction	Lung
Biopsy to prove GVHD is NOT needed for	Liver

ORGAN TRANSPLANTATION

Christian Bernard performed first heart transplantation in	1967
First heart transplantation in India	P.K. Sen of Bombay
Absolute contraindication of heart transplantation	HIV, Irreversible pulmonary hypertension, Malignancy
Kaplan Meir method	**Survival in heart transplantation**
Methods for survival	*Kaplan Meir, actuarial method, survival rate*
Site of islet cell transplant	Injection into portal vein
Before transplantation, complete irradiation is done in	Bone marrow
NOT used for transplantation	Bladder
Transplantation of human organs act	1994
Most important HLA in organ transplantation	HLA D
HLA typing is useful in assessing	Prognosis of disease
HLA matching is NOT necessary for	Liver
HLA typing NOT needed in	Liver transplantation
Allografts of cartilage stored in	Frozen glycerol
Allopurinol in organ preservation as	Free radical scavenger
Immunological reaction against transplanted organ	T-cells
Steroids are used in transplantation	To prevent graft rejection
Commonest complication of immunosuppression	Infection

IMMUNE SYSTEM

TYPES OF IMMUNITY

Immunity inherent to an individual	Native/Innate immunity
Innate immunity differs from acquired immunity by	Affected by previous exposure to antigen
NOT a component of innate immunity	T cells
Cellular Immunity to tumor antigen can be measured by	Lymphocyte mediated cytotoxicity, Lymphocyte blastogenesis, Immunodiffusion
TH2 cells help in	Humoral immunity
Passive Immunity	No latency, No negative phase, No Memory
Acquired passive immunity	Anti diphtheritic serum
Example of artificial passive immunity	Tetanus Immune globulin
Active and passive immunity given together in	Tetanus, rabies, hepatitis B
Autoimmunity due to	Pressure of forbidden clones, expression of cryptic

	antigens, inappropriate expression of MHC proteins

GENERAL FEATURES OF IMMUNE SYSTEM

Temporary immune unresponsiveness to cells	Anergy
NOT immunogenic, acts in presence of antibodies	Hapten
Hapten	Requires carrier for regular antibody production
Combination of proantigen and protein which is antigenic	Hapten
Chemical reacting with preformed antibodies but NOT immunogenic	Haptens
Blood cells do not participate in specific immunological response	Eosinophils
Costimulation	*Ligand CD80, CD86. Receptor CD 28*

SUPERANTIGEN

Toxic shock syndrome caused by Staphylococcus due to	Superantigen
Superantigen	Bind T cells irrespective of antigenic specificity of TCR, bind directly to both MHC II and T cell receptor causing T cell activation, binds directly to lateral aspect of T cell receptor
Superantigen	Directly attached to lateral aspect of TCR beta chain
Superantigen is a bacterial product that	Binds to the beta chain of TCR and MHC class II molecules of APC stimulating T cell activation

MAJOR HISTOCOMPATIBILITY COMPLEX

MHC	Transplant rejection, Autoimmune disease, Involved in T cell function
MHC is present in	T cell, B cell, Macrophages
Epitope binding the floor of MHC molecule consists of	Alpha helices, Alpha and beta 1 chain
MHC restriction is NOT a part of	Autoimmune disorder
MHC restriction to antigen presentation is NOT done for	Graft rejection
Major function of MHC 1 and MHC II	Present the antigen to T cells
Peptide binding site on class I MHC molecules for presenting processed antigens to CD8 T cells formed by	Distal domain of alpha subunit
Portion of MHC I complex forms the component of antigen presenting part	Distal part of alpha chain
Class I MHC	*APC. CD8*
Class II MHC	*DR, DQ, C3. CD4*
MHC class II antigen located on	Dendritic cells, B cells
MHC II presented by	Macrophage, Dendritic cells, Lymphocytes
MHC class II	Not involved in innate immunity, Present in nucleated cells, Present in B cells
MHC II positive cells	Macrophages, B cells
Helper T cells recognize	MHC class II

Monocytes have	MHC II class antigens on their surface
Mixed lymphocyte culture is used to identify	MHC class II antigen
MHC class III gene encode	Tumor necrosis factor, C2, C4, Properdin factor B, HSP70, tyrosine hydroxylase enzyme
HLA class III genes are important element in	Governing susceptibility to autoimmune disease
HLA typing is useful in	Disputed paternity, Organ transplantation
Cell type lacking HLA	RBC
B 27	Ankylosing Spondylitis, Reiter Syndrome, Psoriatic Arthritis
NOT associated with HLA B27	Behcet syndrome, Pernicious anemia
NOT true about HLA B27	Sjogren’s syndrome, Behcet’s syndrome
Anti sera for HLA typing is obtained from	*Multiparous woman*
Eichwald Silmer effect	*Y chromosome linked minor histocompatibility complex*

NATURAL KILLER CELLS

Apart from T and B cell, third distinct type of lymphocyte	NK cells
Percentage of NK cells	*15 – 20% of peripheral blood lymphocytes*
NK cells	Activated by IL 2, variant of large lymphocyte
NK cells	NOT MHC restricted, derived from large granular cells, comprise 5% of human peripheral lymphoid cells, express IgG Fc receptor
NK cell also known as	Large granular lymphocyte
NK cells and cytotoxic cells are differentiated by	*Presence of NK cells in spleen*
NK cell contain	Azurophilic cytoplasmic granules
Natural killer cells attack	Cells which are NOT able to express MHC II
NK cells does NOT affect	*Nucleated cells*
NK cells provide immunity against	Virus
NK cells kill virus infected cells due to	Increased expression of class I MHC molecules
Cytotoxicity of NK cells	Independent of antibody
Components of Innate immunity that are active against virus	NK cells
Interleukin associated with NK-cells	IL-2
NK cells	*CD16 and CD56 positive and CD3 negative*
Feature common to both cytotoxic T cell and NK cell	Requires antibody to be present for action
NOT true about NK cell	Antibody induced proliferation of NK cells
Lethal midline granuloma	*Neoplasm of NK cells*

ANTIGEN PRESENTING CELLS

Most important APC in human	Langerhan cells/Histiocytes
Antigen presenting cells are	Endothelial cells
Antigen presenting cells are	B cells, Macrophages, Langerhan cells
Most potent stimulator of naive T cell	Mature dendritic cell

NOT an antigen presenting cells	T cells and fibroblast
Function of Langerhan cell	Antigen presentation
Ocular Dendritic Cells have	Both HLA 1 and HLA 2

T CELLS, B CELLS AND PLASMA CELLS

Common between T and B cells	Origin from same lineage, Further differentiation seen
Properties NOT shown by B cell and T cell	Positive selection
Pre B cells and B cells are produced in	Bone marrow
Gamma globulins are mainly synthesized by	B cells
Macroglobulin is derived from	B cells
Cells that must cooperate with B cells to produce antibody in response to certain antigens	Macrophages
Kupffer cells are found in	Liver
Plasma cells	Help in formation of antibody
Transfer factor in transfer of CMI is obtained	Leucocytes
Principal cells in lymph nodes cortical centre	T-lymphocytes
Delayed hypersensitivity involve	T lymphocytes
Helper and cytotoxic cells belong to	T cells
Cell mediated immunity is by	T cells
Enhances multiplication of T cells in culture	Phytohemagglutinin
E rosettes test is for	T lymphocytes
TH1 mediated inflammatory response	*Atherosclerosis, multiple sclerosis, psoriasis*
Th2 mediated inflammatory response	*Asthma, atopic dermatitis*
Normal CD4 to CD8 ratio	2:1
T4/T8 ratio reversal in	AIDS
CD4 important for	Antibody production, Opsonisation, Memory B cells, Cytotoxicity of T cells, Activation of macrophage
Functions of CD4 helper cells	Immunogenic memory, activate macrophage, activate cytotoxic cells
Cells interacting with B cells in humoral immunity	TH2 cells
Type of T-lymphocyte responsible for histocompatibility restriction	Helper T cells
T cells function are assessed by	Migration inhibition test
NOT a function of CD4	Immunoglobulin production
NOT a function of CD4	Opsonisation
Perforins are produced by	Cytotoxic T cells
Omenn syndrome	**T cell deficiency subset**

LYMPHOID ORGANS

Primary Lymphoid organs	Thymus, Bone marrow
Central lymphoid organ	Bone marrow, thymus
Thymus	Hassall corpuscles are highly characteristic, Histology varies with age, Thymic corpuscles are seen in medulla, Medulla has more reticular cells
Great vein of Keynes is associated with	*Thymus*

Hassall corpuscles	Thymus
Hassall corpuscles are derivatives of	T cells
Neonatal thymectomy leads to	Decreased size of paracortical areas
Thymectomy cause	Failure of rejection of transplanted organs
Thymic hypoplasia is associated with	*Di George syndrome, common variable immunodeficiency, ataxia telangiectasia*

DISEASES OF IMMUNE SYSTEM

BRUTON'S AGAMMAGLOBULINEMIA

Bruton's agammaglobulinemia	Opsonisation affected
Defect in Agammaglobulinemia is	B cell precursors
Diagnosis of X linked agammaglobulinemia is suspected if	Absent tonsils and no palpable lymph nodes on physical examination

SEVERE COMBINED IMMUNODEFICIENCY

MC primary immunodeficiency	Isolated IgA deficiency
SCID	Failure of descent of thymus, X linked type is common, gene therapy
MC phenotype of SCID	**Absence of T and NK cells**
Adenosine deaminase deficiency is seen in	SCID
Combined immunodeficiency in children	Decreased total serum immunoglobulin, Defective T cell function, Recurrent pulmonary infection
ADA deficiency cause SCID because of	*Lack of deoxynucleotides*
NOT a feature of combined immunodeficiency in children	Neutropenia and eosinophilia
Gene therapy given in	SCID
Reticular dysgenesis is associated with	**Adenylate kinase 2 deficiency**

JOB'S SYNDROME

Hyper IgE /Job syndrome	Inheritance is as a single locus autosomal dominant trait with variable expression, Coarse facial features, Recurrent staphylococcal abscess involving lungs, IgE increased, IgG, IgA, IgM normal
Cold abscess due to staphylococcus aureus is associated with	*Job's syndrome*
Job's syndrome is associated with	*Red hair, Leonine facies*

HYPER IGM SYNDROME

CD40	*Begins isotype switching*

Hyper IgM syndrome is associated with	*CD40 ligand mutation*

AUTOIMMUNE DISEASES

EBV causes autoimmunity by	Polyclonal B cell activation
Autoimmune diseases	SLE, Grave's disease, Myasthenia gravis
Autoimmune diseases common in women	*ITP, multiple sclerosis, scleroderma*
NOT an autoimmune disease	Syphilis

DI GEORGE SYNDROME

Di George syndrome	*22q microduplication*
Di George syndrome	Congenital thymic hypoplasia, Abnormal development of third and fourth pouch, Hypocalcemic tetany
Di George syndrome	Defect in cell mediated immunity
Di George syndrome is	T cell defect
Di George syndrome is associated with	*Truncus arteriosus*
NOT a feature of Di George Syndrome	Esophageal Atresia

ANTIBODIES ASSOCIATED WITH DISEASES

Anti Yo	**Ca ovary, ca breast**
Anti Ri	**Ca breast, gynecological malignancies, small cell lung cancer**
Anti Tr	**Hodgkin's lymphoma**
Anti Ma	**Testicular cancer**
Anti amphysin	**Ca breast, small cell lung cancer**
Anti GAD	**Thymoma**
Anti Ach receptor	**Small cell lung cancer**

ANTIGEN AND ANTIBODY

ANTIGEN

Smallest unit of antigen	Epitope
Very difficult to induce antibody	Polysaccharide
Polysaccharide antigen	*T cell dependent (does NOT induce germinal centres, no memory cells, mainly IgM antibodies, cannot elicit immune response in less than 2 years, hyporesponsiveness on further dose, example is group C meningococci*
Carbohydrate antigens	Poor immunogenicity, T cell independent immunity, Polyclonal response

Frossman antigen	Species specific antigen
Frossman antigen	Lipid carbohydrate complex
Isoantigens	Found in some but NOT all members of species
Most sensitive test for antigen detection	Radioimmunoassay (RIA)

ANTIBODY

Antigen combining site of antibody	Paratope
Prozone phenomenon is due to	Antibody excess
Synthesis of antibody protein takes place	By general mechanism of protein synthesis
Virus infected cells are killed by	Macrophages
Idiotypic antibodies have identical	Variable portion of both heavy and light chains
Clonal selection	Specific, Secondary response is rapid, Variable region of immunoglobin is involved in antibody production
Following injection of lymphokines, same class of immunoglobulins produced	Clonal selection
Secondary immune response	Antibody appears in short time and persist for long time
Lysozyme is NOT found in	CSF, sweat, urine

ANTIGEN ANTIBODY INTERACTION

Antigen antibody precipitation is maximally seen in	Equivalence of antibody and antigen
Reaction between antibody and soluble antigen is demonstrated by	Precipitation
NOT involved in antigen antibody interaction	Covalent bond
Antigen antibody reaction can NOT occur in absence of	Electrolytes
Danysz phenomenon	Toxin antitoxin in multiple proportions
Antigen antibody complexes are detected by	Western blot, ELISA

TESTS FOR ANTIGEN AND ANTIBODY

Sensitization of RBCs with incomplete antibodies in vivo	Direct coomb's test
Raji cell assays used to quantitate	Immune complexes
Neutralization test	ASLO
VDRL test is	Slide Flocculation test
Paul Bunnel test uses	Sheep RBCs
Paul bunnel antibodies are reactive in	Dog, sheep, horse
Heterophile agglutination test	Weil Felix test, Paul Bunnel test, Streptococcus MG
NOT a rapid serologic diagnostic test	Spectrophotometry

IMMUNOGLOBULINS

STRUCTURE OF IMMUNOGLOBULIN

Single immunoglobulin molecule contain	2 light chain and 2 heavy chain
Structure of antibodies is composed of	2 long and 2 short peptide chain
Precipitates at 50-60*C but disappears on heating	Light chain
Class specific determination of an immunoglobulin	H chain
Portion of immunoglobulin with molecular weight of 50,000	H chain
Variable potion of antibody molecule	N terminal

PHYSIOLOGY OF IMMUNOGLOBULIN

Location of Ig chromosome	Kappa – 2, Lambda – 22
Ig gene rearrangement and Ig diversity	Somatic mutation theory, DNA rearrangement, Appropriate class switching
Antibody diversity is due to	Antigenic variation
Isotypic variation	Changes in heavy and light chain in constant region responsible for class and subtype
Factor deciding whether antibody is membrane bound or secreted	Differential RNA processing
Molecular phenomenon in Ig gene is responsible for affinity maturation of antibody response	Somatic hypermutation
Antigen driven B cell activation occurs through BCR	**Somatic hypermutation**
Antibodies are secreted by	Plasma cells
Antigen binding site on antibody	Hypervariable region, Idiotype region
Functional secretory immunoglobulin formation	*Gene rearrangements, isotype switching, idiotype switching*

GENERAL FEATURES OF IMMUNOGLOBULIN

No of constant region in IgG, IgA, IgD	3
No of constant region in IgM, IgE	4
Correct order of switching of Immunoglobulin	IgM to IgG, IgM to IgA
Immunoglobulin to be fix complement via classical pathway	IgM > IgG
Classic complement is activated by	IgM and IgG
Immunoglobulin to fix complement via alternate pathway	IgA and IgD
Immunoglobulins present in seromucinous glands	IgG and IgA
A 5 year old boy who has history of recurrent pyogenic infections by bacteria with polysaccharide rich capsules, which of the following investigations should be done	IgA and IgG2
Russel bodies	*Cytoplasmic or extracellular*

Dutcher bodies	*Nucleus (seen in Waldenstrom macroglobinemia)*
IV immunoglobulins used in treatment of	Myasthenia gravis, ITP, Kawasaki disease, GBS, Wiskott Aldrich syndrome, X linked agammaglobulinemia, Bruton's agammaglobulinemia
IV immunoglobulin NOT indicated in	PAN
Utilize labeled antibodies	ELISA, Radioimmunoassay, immunofluorescence
Method NOT utilizing labeled antibodies	Hemagglutination inhibition test
Increased macroglobulin	Multiple myeloma, Disseminated Lupus Erythematosis, Cirrhosis
Antibodies of following condition may be transmitted from mother to fetus	Rh incompatibility, isoimmune thrombocytopenia, myasthenia gravis

IG G

IgG	Immunoglobulin a/w Chronic ITP, Precipitation reaction, Crosses placenta, Warm antibody type of Hemolytic anaemia, Coombs direct test is positive with, Secondary immune response is mediated by, M spike in multiple myeloma
IgG with maximum concentration	IgG1
Half Life of IgG	23 days
Immunoglobulin responsible for hypersensitive pneumonitis	IgG
Secondary immune response	IgG
Maximum serum concentration	IgG
Maximum half life	IgG
Rich source of IgG	Small intestine
MC IgG with antigenic variation	*IgG2*
Does NOT fix complement	*IgG4*
Low IgG is seen in	*Nephrotic syndrome, multiple myeloma, CLL*

IG A

IgA	Exocrine secretion, Mucosal immunity, Immunoglobulin formed after administration of OPV, Immunoglobulin mostly affected in Kwarshiorkar, Respiratory and gastrointestinal infection, Absent in Ataxia telangiectasia, Commonest immunoglobulin deficiency
IgA	Monomer, dimer
IgA is produced by	*Plasma cells in lamina propria*
Shortest half life	IgA
Least concentration	IgA
Alternate pathway	IgA
Local Immunity	IgA
Bronchial secretion contains	IgA
Secretory component of IgA molecule	Formed by epithelial cell and plasma cell

Selective IgA deficiency	Phenytoin

IG M

IgM	Most Avid Complement fixing Immunoglobin, Earliest immunoglobulin to be synthesized by fetus, First antibody to appear following infection, Only immunoglobulin in fetal life, Opsonisation, Pentametric structure, lymphoplasmocytoid lymphoma, Cold agglutinin, Fix complement, Increased in primary response, Fab region is composed of variable region
J chain in	**IgM**
Pentamer	**IgM**
Maximum sedimentation coefficient	IgM
Maximum molecular weight	IgM
Primary immune response	IgM
Waldenstorm's macroglobinemia	IgM producing plasma cells
Specific IgM	Detection of acute infection

IG D

IgD	Immunoglobulin found in B Lymphocyte, Delta chains, Heat stable, Least important immunoglobulin in human beings
Delta heavy chain	IgD
Immunoglobulin involved in activation of B cells	*IgD*

IG E

IgE	Immunoglobulin having highest Carbohydrate, Type I hypersensitivity, Generalised edema, Sweating following test dose of a drug, Reaginic immunoglobulin, Ovalbumin injected into rabbit produced
Immunoglobulins with shortest half life	IgE
Heat labile	IgE
Homocytotropism is seen in	IgE
Mediating Prausnitz Kustner reaction	IgE
Minimum serum concentration	IgE
IgE is secreted by	Plasma cells
IgE receptors are present on surface of	Mast cells
Activation of IgE attached to Fc receptor occurs at	Surface of mast cells and basophils
Carbohydrate content is maximum in	*IgE*
Not true about IgE	IgE crosses placenta and does complement fixation

HYPERSENSITIVITY

GENERAL FEATURES OF HYPERSENSITIVITY REACTIONS

Skin tests are used for	Type I,III and IV
Allergic fungal sinusitis	Type I and Type III hypersensitivity
Hypersensitivity pneumonia	Type III hypersensitivity> Type IV Hypersensitivity
Farmer's lung	*Type III, type IV hypersensitivity*

TYPE I HYPERSENSITIVITY

Type I	Anaphylaxis, Theobald smith phenomenon, Casoni's test
Associated with mast cells and basophil	Type I hypersensitivity
IgE is secreted in	Type I hypersensitivity
In immediate hypersensitivity mediators are secreted from stored granules of	Mast cells
Occult filariasis is caused by	Hypersensitivity to Filarial antigen
Anaphylaxis	Type I reaction, Large amount of histamine released, Cytokines are IL4, IL5, IL6 and GMCSF, Mediated through allergen specific IgE
Anaphylaxis refers to	*Severe reaction following reinjection of protein solution in a sensitized animal*
Immediately after eating, swelling of face and lips, respiratory distress, feeling of impending doom	Anaphylaxis
Single dose can cause hypersensitivity in	Anaphylaxis
Minimum dose exposure is needed for	Anaphylaxis
Animal used to demonstrate anaphylaxis in lab	Guinea pig

TYPE II HYPERSENSITIVITY

Type II	Autoimmune hemolytic anaemia, Transfusion reaction, Intermediate between hypersensitivity and autoimmunity, Myasthenia gravis, Hemolytic disease of newborn
Membranous glomerulonephritis	Type II
Acute transplant rejection	Type II
NOT a type II hypersensitivity	*Hemorrhagic group of newborn*

TYPE III HYPERSENSITIVITY

Type III	Serum sickness, Arthus reaction, Hyperacute rejection of renal transplant, Rheumatoid arthritis, SLE, Immune Complex deposition, Type II lepra reaction, Farmer lung

2 year male, 8 days of cefaclor 10 days course. low grade fever, malaise, lymphadenopathy, irritability, generalised erythematous rash, mildly pruritic	Type III hypersensitivity
Serum sickness	Type III hypersensitivity

TYPE IV HYPERSENSITIVITY

Hypersensitivity that cannot be transferred with serum antibody	*Type IV*
Type IV	Contact dermatitis, Granulomatous reaction, Allograft rejection, Leprosy, Tuberculin test, Type I lepra reaction, Granuloma
Contact dermatitis	Type IV hypersensitivity
Allograft rejection	Delayed hypersensitivity
Type IV hypersensitivity to Mycobacterium tuberculosis antigen may manifest as	Phlyctenular conjunctivitis
Jones Mote reaction	Cutaneous basophilic hypersensitivity (type IV hypersensitivity)

IMMUNOHISTOCHEMISTRY MARKERS

Langerhan cell histiocytosis	CD 1a
Pan T lymphocyte	CD3
Marker for NK cells	CD16 and CD56
Marker for B lymphocyte	CD 19
Marker for B lymphocyte	CD 19,20,22
CD20 is also known as	*L26*
CD 25	**Hairy cell leukemia, Adult T cell leukemia**
Cell surface molecule involved in peripheral tolerance	B7 and CD28
CD 30	**Hodgkin's lymphoma, anaplastic large cell lymphoma**
Homologous to heat stable antigen	*CD24*
Most often expressed in human hematopoietic stem cell	CD 34
CD 41	*Megakaryocytic marker (Gp IIb/IIIa)*
Granulocytic sarcoma	CD 43, Myeloperoxidase, Lysozyme
Memory T cells identified using	CD45RO
Ewing's sarcoma	CD99
Hairy cell leukemia	CD103
Hairy cell leukemia	CD11c, CD103
GIST	CD 117
Myeloid series	CD117
CD133	*Hematopoietic stem cells, endothelial progenitor cells, glial stem cells*
Melanoma	S100
Marker for lymphoma	Leucocyte common antigen
Marker specific for Myeloid lineage	MPO
NOT a B cell marker	CD34

NOT a B cell marker	CD15, CD134
BRST 1, ER and PR, gross cystic disease fibrous protein	**Breast**
CD 56, chromogranin, synaptophysin	**Neuroendocrine**
CDX2	**GIT cancer**
Calretinin, mesothelin	**Mesothelioma**
HMB 45, tyrosinase, Mela A	**Melanoma**
URO III, thrombomodulin	**Bladder cancer**
WT 1, ER	**Ovarian cancer**
RCC, CD 10	**RCC**
Merkel cell carcinoma	NSE, Neurofilament, chromogranin, CK 20
HAM56	Malignant fibrous histiocytoma
TA 90 is a marker for	Malignant melanoma

VACCINATION

GENERAL FEATURES OF VACCINATION

First immunization of baby	Colostrum
Active immune prophylaxis after infection	Rabies, measles, hepatitis, varicella, tetanus
Antisera is obtained from	Horse
Ring vaccination	Given around 200 yards of a case detected
Secondary booster response in comparison to that of primary response are	Shorter latent period, Antibody is maximum, Antibody responses maintained at higher levels for longer period of time
Premunition	State of active immunity, Protects an individual, Immunity depends on the presence of an inactive infection with the same species in the host
Vaccination is based on principle of	Immunological memory
Vaccines given below 1 year	Polio, DPT
Protective value of a vaccine is 95% means	5 among 100 have probability of getting infected after vaccination
Vaccine is yet to be available for	Dengue
Toxoid vaccines	Microorganism produce exotoxins
Human immunoglobulin is given in	Rabies, Hepatitis B, Chicken pox
Exposure mandates passive immunization with standard immune serum globin	Hepatitis A
Vaccines required before Haj	**Meningococcal meningitis, Influenza**
Mazucchi vaccine	Bacillus anthrax
Strains for Polio virus	Lansing, Leon, Brunshide
Strain for diphtheria	Park Williams
Vaccines damaged by freezing	DT, DPT, TT, hepatitis B
Least effective vaccine	BCG
Most effective vaccine	MMR, Varicella, Measles
Vaccines least sensitive to heat	TT > BCG before reconsitution
Vaccine efficacy	1 – (incidence of disease in

	*vaccinated/incidence of disease in unvaccinated) * 100*
Wastage multiplication factor for OPV	*1.27*
Wastage multiplication factor for BCG	*2*

LIVE AND KILLED VACCINES

Both live and killed vaccines in	Polio, Typhoid, Plague
Live vaccine	Two live vaccines should not be given at one time
Live vaccines	Booster doses are not required, Single dose gives lifelong immunity, Live vaccines contain both major and minor antigens
Live vaccines	Cannot be given in leukemia, Live vaccines engage certain tissues of body
Live vaccines	BCG, OPV, chickenpox, MMR, Measles, Japanese encephalitis
Live vaccines	Latent phase, Negative phase, Both humoral and cellular response, Immunological memory
19 brucellosis vaccine is a	*Live vaccine*
Minimum gap between two live vaccines	4 weeks
NOT a live vaccine	Influenza
NOT a live vaccine	Pneumococcus, Hepatitis B
NOT a live attenuated vaccine	Diphtheria
False about live vaccine	Two live vaccines cannot be administered simultaneously
Killed vaccine	Tetanus, cholera
Plague vaccine	*Killed vaccine*
IM vaccination is preferred in	*Killed vaccine*

UNIVERSAL IMMUNIZATION PROGRAMME

Age group of children under UIP	Under fives
Target by which primary immunization is to be completed under UIP	1 year

NATIONAL IMMUNISATION PROGRAMME

NOT included in national immunization programme	Hepatitis B

EXPANDED PROGRAMME FOR IMMUNISATION

In WHO recommended EPI cluster sampling for assessing primary immunization coverage, age group of children surveyed	12-23 months
NOT included in EPI schedule	MMR

NOT included in expanded programme for immunization	Influenza

ADJUVANT

Role of adjuvant in vaccine	Stimulation of toll like receptors, Increase both adaptive and innate immunity, Activate both B and T lymphocyte, Ensured prolonged delivery of antigen
Adjuvant vaccine	Causes slow release of vaccine from injection site, enhances humoral and cell mediated immunity immunogenicity
Main use of adjuvant is to increase	Antigenicity
Adjuvant enhances	Immunogenicity of antigen

HERD IMMUNITY

Herd immunity	Group protection beyond what is afforded by protection of immunized individuals, affected by presence and distribution of alternate animal hosts, in that case tetanus does NOT protect the individual
NOT true about herd immunity	Herd structure is constant

STORAGE OF VACCINES

Vaccines stored in PHC in	ILR
Vaccines at PHC are stored in	Ice lined refridgerator
Temperature in an ILR at PHC recorded by	Dial thermometer
Vaccines can be stored in PHC for	30 days (5 weeks)
Vaccine is stored in walk in cold room for	*3 months*
Storage temperature of vaccine	2 to 8 *C
Vaccine stored in PHC at	2*C to 8*C
No of fully frozen ice pack in vaccine carrier	4
Equipment essential for outreach	Vaccine carrier and cold boxes
Vaccine discarded if vaccine vial monitor	Inner square darker than outer circle
Vaccine stored in sub centre for	1 day
Risk of cold chain failure highest at	Sub centre and village level
Vaccines NOT to be frozen	DPT, BCG, Measles, TT

MEASLES VACCINE

Vaccine with best efficacy	Measles
Most effective vaccine	Measles
Vaccine having maximum efficacy after single dose	Measles
Live virus used for active immunization against	Measles
Efficacy of Measles vaccine	85 %

Measles	*Edmund Zagreb strain*
Measles vaccine	Freeze dried, After 9 months of age, Reconstituted vaccine should be used within one hour
Measles vaccine NOT given before	9 months
Diluents in measles vaccine	*Distilled water*
Preservative in measles vaccine	Kanamycin
NOT true about measles vaccine	Diluents not required
Most adverse effect of Measles vaccine	Toxic shock syndrome
Toxic shock syndrome is due to	Measles vaccine
No of doses of measles vaccine required for a PHC with wastage of 50% vaccine to cover a population of 5000 live births, birth rate 30/1000 IMR 100/1000	270
100 children, 28 immunized against measles, 2 of them acquire measles simultaneously, subsequently 14 get measles, assuming efficacy of vaccine to 100%, secondary attack rate	13.8

RUBELLA VACCINE

First priority group of rubella vaccination	All non pregnant woman of age 15 to 34
Vaccine need NOT to be given to boys	German measles
Rubella vaccine is contraindicated in	Malignancy, Leukemia, immunosuppression
Vaccine contraindicated in pregnancy	Rubella
Gap between rubella vaccination and pregnancy	*1 month*
Correct mode and dose of administration of rubella vaccine to prevent rubella in future pregnancy is by giving	*RA 27/3 vaccine in dose of 0.5 ml subcutaneously*

CHOLERA VACCINE

Certificate of Cholera vaccination is valid after	6 days
Minimum age for cholera vaccine	*1 year*

TYPHOID VACCINE

Best vaccine for typhoid	Typhoid oral
Ty21a can be given to children after	6 years
Oral typhoid vaccine	Live attenuated vaccine
Vi polysaccharide vaccine	Can be administered with yellow fever and hepatitis B vaccine
Minimum age for typhoid vaccine	*2 years*

YELLOW FEVER VACCINE

Live vaccine	Yellow fever vaccine
Yellow fever vaccine starts protection after	10 days of vaccination
Live vaccination	17 D
Vaccine contraindicated in pregnancy	Yellow fever

PNEUMOCOCCAL VACCINE

Pneumococcal vaccine is	Killed vaccine
Minimum age for pneumonia polysaccharide vaccine	*2 years*
Minimum age for PCV vaccine	*6 weeks*

ORAL POLIO VACCINE

Vaccine that can be thawed and frozen without damage to the vaccine	*OPV*
Most heat sensitive vaccine	Polio
OPV is stored in	Tray below freezer
Efficiency of cold chain system for OPV as monitored by VVM depends on	Change in color of monitor
Polio vaccination	Salk contains 3 types of polio vaccine, Pulse polio doses are extra and supplemental, OPV gives intestinal immunity also
OPV	Residual neuroparalysis is a complication, Requires sub zero temperature for storing long term, Induces intestinal and humoral immunity
Live vaccine	Sabin
Vaccine NOT given to immunocompetent siblings of immunocompromised children	OPV
NOT a freeze dried vaccine	OPV
True about OPV all except	Maternal antibody interfere with immune response
Vaccine that should NOT be given in HIV	OPV
Concentration of Type 3 virus in OPV	300000 TCID
Used to stabilize OPV	Magnesium chloride
MgCl2 added to polio vaccine because	Vaccine can be kept at higher temperatures
Zero dose OPV given at	Birth
Number of OPV dose in national immunization programme	5
No of doses of OPV in Primary immunization	3
Target age group in Pulse Polio immunization	Under 5 years
Vaccine administration that can lead to paralysis	Sabin
Lameness survey in AFP carried out	8 years
Dropout rate for OPV	*[(no received first dose – no received last dose)/no received first dose] * 100*

Overall dropout rate	*[(highest covered antigen dose – lowest covered antigen dose/lowest covered antigen dose] * 100*

REVERSE COLD CHAIN

Reverse cold chain is seen in	Stool specimen of polio send for testing
Reverse cold chain	Carrying stool samples of polio patients from PHC to lab

INJECTABLE POLIO VACCINE

Important indication of IPV	Immunodeficiency
Virus content of IPV	10000 more than OPV
Inactivated vaccine	Salk

DPT VACCINE

Ideal temperature for DPT storage	4 – 8 * C
DPT vaccine stored at	4*C
DPT vaccine	Aluminium adjuvant, whole killed bordetella pertussis adjuvant effect, acellular pertussis increases immunogenicity
DPT vaccine	Exposure to direct sunlight when in use should be avoided, Store stocks are needed for three months at PHC level, Half used vials should not be put back into the cold chain after the session
DPT can be safely and effectively administered as early as	*6 weeks*
Disease preventing by giving booster dose in 5-6 years	DPT
Number of Loeffler units of diphtheria toxoid is incorporated in DPT vaccine per dose	25
Percentage of herd immunity necessary to prevent spread of diphtheria	*>70%*
NOT true about DPT	Presence of a cellular pertussis component increases immunogenicity
NOT true about DPT	Should be stored in deep freezer
Preservative in DPT	Thiomersal
Adjuvant used for DPT	Aluminium
Highest frequency of minor vaccine reaction	*DPT*
Excessive crying is seen with	DPT
Neurological complication of DPT due to	Pertussis component
Local pain in DPT due to	Pertussis component
Encephalitis following DPT due to	DPTw
Vaccine should NOT be given in convulsions	DPT
Vaccine contraindicated in children with history of	DPT

convulsions	
DPT is contraindicated in	Evolving neurological illness
NOT a contraindication to DPT vaccine	Local reaction to previous DPT
NOT a contraindication of DPT vaccine	Children below 2 years of age
Acellular pertussis vaccine contains	Flagellary haemagglutinin, pertussis toxin, fimbriae

BCG VACCINE

Only vaccine with T cells as effectors	*BCG*
Vaccine given earliest	BCG
BCG	Can be given in tuberculin negative patient, Prevent hematogenous spread, Prepared from M.bovis
Color of BCG vials	*Amber colored*
BCG	Danish 1331
BCG is a	Live attenuated vaccine
Freeze dried vaccine	BCG
BCG vaccine	Intradermally
Site of BCG injection	*Left deltoid*
Diluent for BCG	Normal saline
Reconstituted BCG vaccine should be used within	*3 hours*
Efficacy of BCG vaccine	80%
BCG vaccine prevents	Tuberculous meningitis
BCG is given in child for prevention of	Meningeal and Miliary TB
BCG	Mantoux test positive in 6 weeks
Vaccine contraindicated in child with AIDS	BCG

MMR VACCINE

Mumps	*Jeryll Lynn strain*
Minimum age for MMR vaccine	*1 year*
MMR vaccine is given at	1 ½ years
MMR vaccine	15-18 months
ITP caused by	MMR vaccine
Vaccine contraindicated in pregnancy	MMR

RABIES VACCINE

Rabies vaccine strain	*Pitts moore*
Vaccine prepared by embryonated hen eggs	*Rabies*
Commercially available rabies vaccine	*Killed sheep brain vaccine, human diploid cell vaccine, vero continuous cell*
Vaccine recommended for Rabies	*HDCV*
Vaccine recommended for Rabies by WHO	*Chick fibroblast*

Rabies vaccine	BPL vaccine has more number of doses
Semple vaccine is an	Outdated vaccine
Non neural rabies vaccine	Human diploid cell line
Best vaccine for Rabies	Human diploid call vaccine
Pre exposure prophylaxis for rabies using Human diploid cell vaccine	3 doses
Rabies vaccine for pre exposure prophylaxis	0, 7, 28
Post exposure HDCV	*0,3,7,14,28, booster at 90*
Post exposure prophylaxis for those who has been vaccinated already	*0,3,7*
Eight site rabies vaccination schedule	8-0-4-0-1-1
Anti Rabies vaccine is NOT given through	Buttock
Active immunization following exposure is commonly for	Rabies
Post exposure immunization is indicated for	Rabies
Recommended dose of human rabies antiserum to be given for passive immunization of adult victim of dog bite	20 IU
Dose of Equine rabies anti immunoglobulin	40 IU per kg body weight
Management of unprovoked bites	Post exposure prophylaxis started

INFLUENZA VACCINE

Live vaccine of Influenza is given	Intra nasally
Vaccine administered as nose drops	Influenza
Minimum age for influenza vaccine	*6 weeks*

HEPATITIS A VACCINE

According to immunization schedule, hepatitis A vaccine recommended at	2 years
Hepatitis A vaccine	**IgA vaccine**
Vaqta, Havrix	*Hepatitis A vaccine*
Minimum age for hepatitis A vaccine	*1 year*
Strain for HAV vaccine	*Hm175*

HEPATITIS B VACCINE

Hepatitis B vaccine	*Quadrivalent*
Conjugated vaccine	Hepatitis B
HBV vaccine is	Sub unit Killed vaccine
NOT a mandatory vaccine for 1st year of Life	Hepatitis B

HEMOPHILUS INFLUENZA B VACCINE

Vaccine that should NOT be given to elderly man	H.influenza
Component in hemophilus influenza vaccine	*Polysaccharide derived from H. influenza conjugated to a protein antigen*

CHICKEN POX VACCINE

Chicken pox	OKA strain
Minimum age for varicella vaccine	*1 year*

MENINGOCOCCAL VACCINE

Group of meningococci for which vaccine is available	A & C
Vaccine prophylaxis NOT needed for contacts of	Meningococci group B
Vaccine should NOT be given in infants	Meningococcal vaccine

JAPANESE ENCEPHALITIS VACCINE

Primary dose of Japanese encephalitis vaccine	2 doses

ROTAVIRUS VACCINE

Rota virus vaccine is administered	Orally
Minimum age for rotavirus vaccine	*6 weeks*

HPV VACCINE

Quadrivalent HPV vaccine protects against	6,11,16,18
NOT true about HPV vaccination	2 primary doses for immunization, Recommended for age group 20-40 years

VACCINATION OF UNIMMUNISED CHILD

10 month unimmunized child should be given	BCG,DPT1,OPV1,Measles,vitamin A
A 11 month old child has received 2 doses of OPV and DPT, comes for further immunization after 5 months of last dose	Give 3rd dose and continue the rest of course
18 months old	One dose of DPT and OPV 2 months of age. next immunization plan
18 months old child, who has received one dose of DPT and OPV at 2 months of age. next immunization plan	Restart immunization schedule as per age

3 ½ year old unimmunized child	BCG,DPT1,OPV1,measles,vitamin A
4 year old child presented to OPD with vaccination history of receiving one dose of OPV and DPT at 2 months of age	Measles should be given, Hepatitis B vaccine should be given
Immunisation of 5 year child who has NOT been immunised	DPT,OPV, vitamin A
A 6 years old male boy having no immunization	BCG, OPV, Measles, DT
Vaccines NOT given in an eight year old unimmunized child	Pertussis, Salk vaccine, BCG